US008425371B2

(12) **United States Patent**
Hart et al.

(10) **Patent No.: US 8,425,371 B2**
(45) **Date of Patent: Apr. 23, 2013**

(54) **MULTI-SPEED TRANSMISSION HAVING THREE PLANETARY GEAR SETS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 281 days.

(21) Appl. No.: **12/834,322**

(22) Filed: **Jul. 12, 2010**

(65) **Prior Publication Data**

US 2011/0034287 A1 Feb. 10, 2011

Related U.S. Application Data

(60) Provisional application No. 61/231,605, filed on Aug. 5, 2009.

(51) **Int. Cl.**
F16H 3/44 (2006.01)
F16H 37/06 (2006.01)

(52) **U.S. Cl.**
USPC **475/280**; 475/269; 475/282; 475/284; 475/330

(58) **Field of Classification Search** 475/280
See application file for complete search history.

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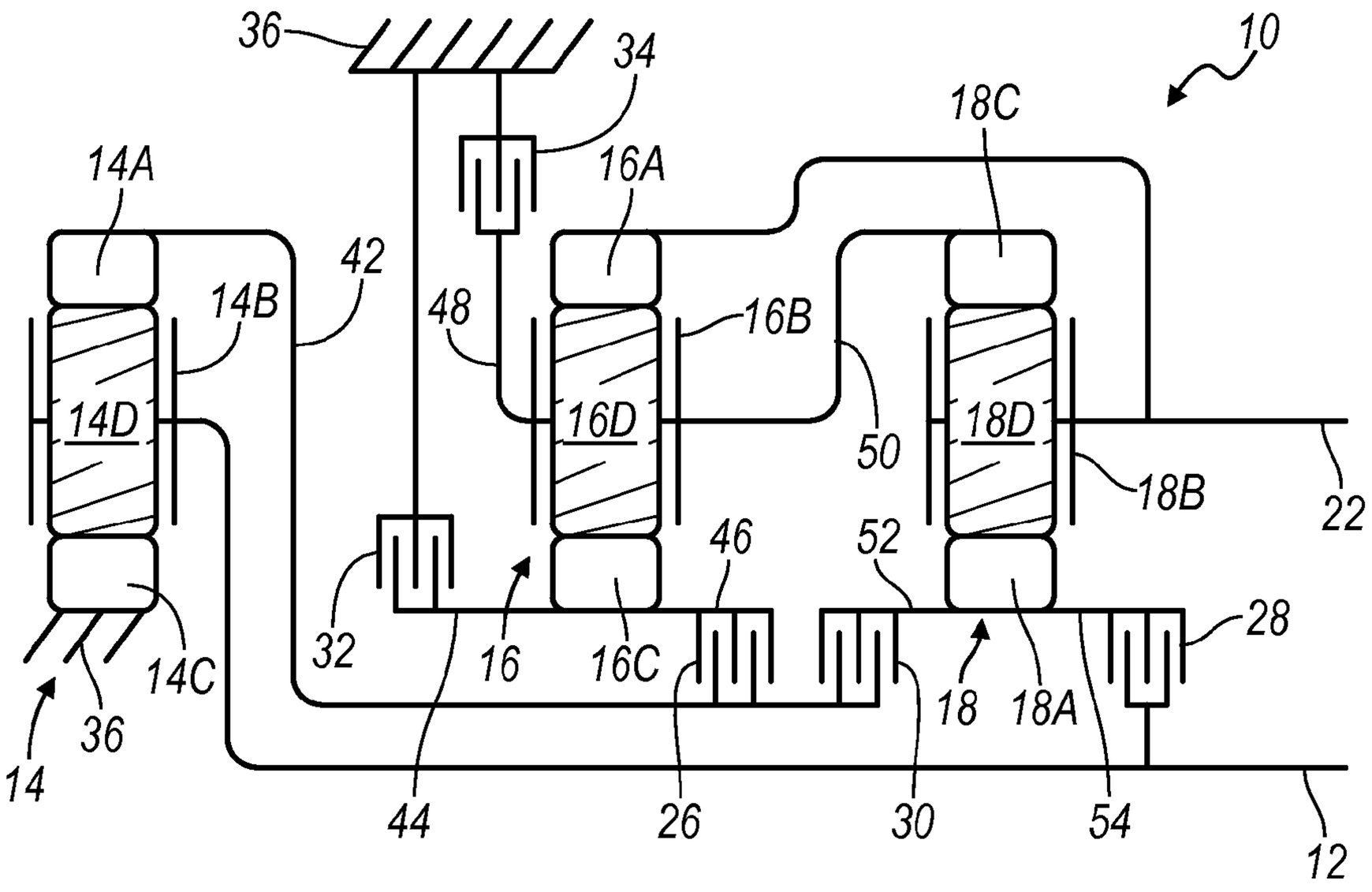
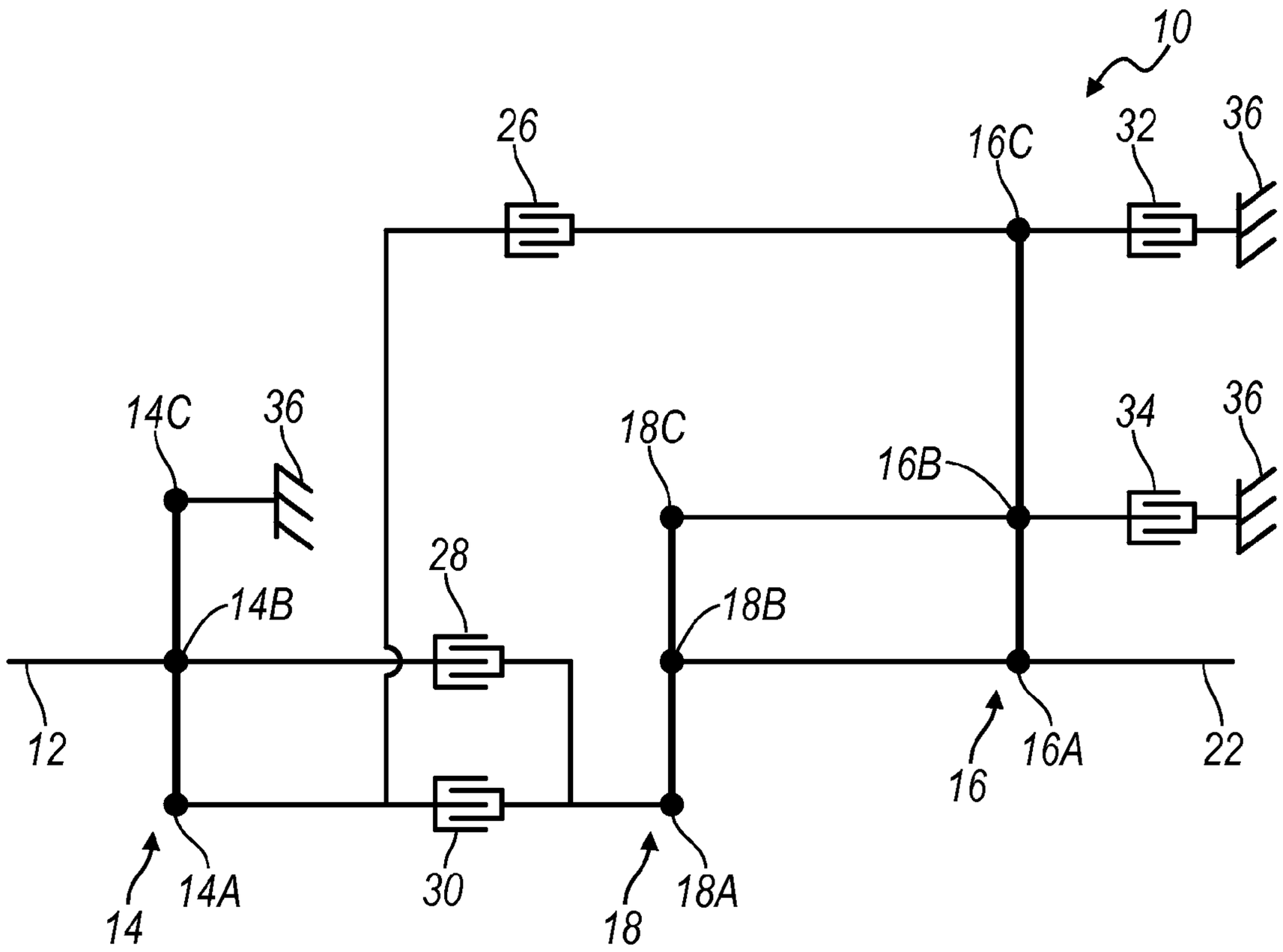
Assistant Examiner — Colby M Hansen

(57) **ABSTRACT**

A transmission is provided having an input member, an output member, three planetary gear sets, a plurality of coupling members and a plurality of torque transmitting devices. Each of the planetary gear sets includes first, second and third members. The torque transmitting devices include clutches and brakes.

26 Claims, 8 Drawing Sheets

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14C
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18C
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16B
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14B
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14
14A
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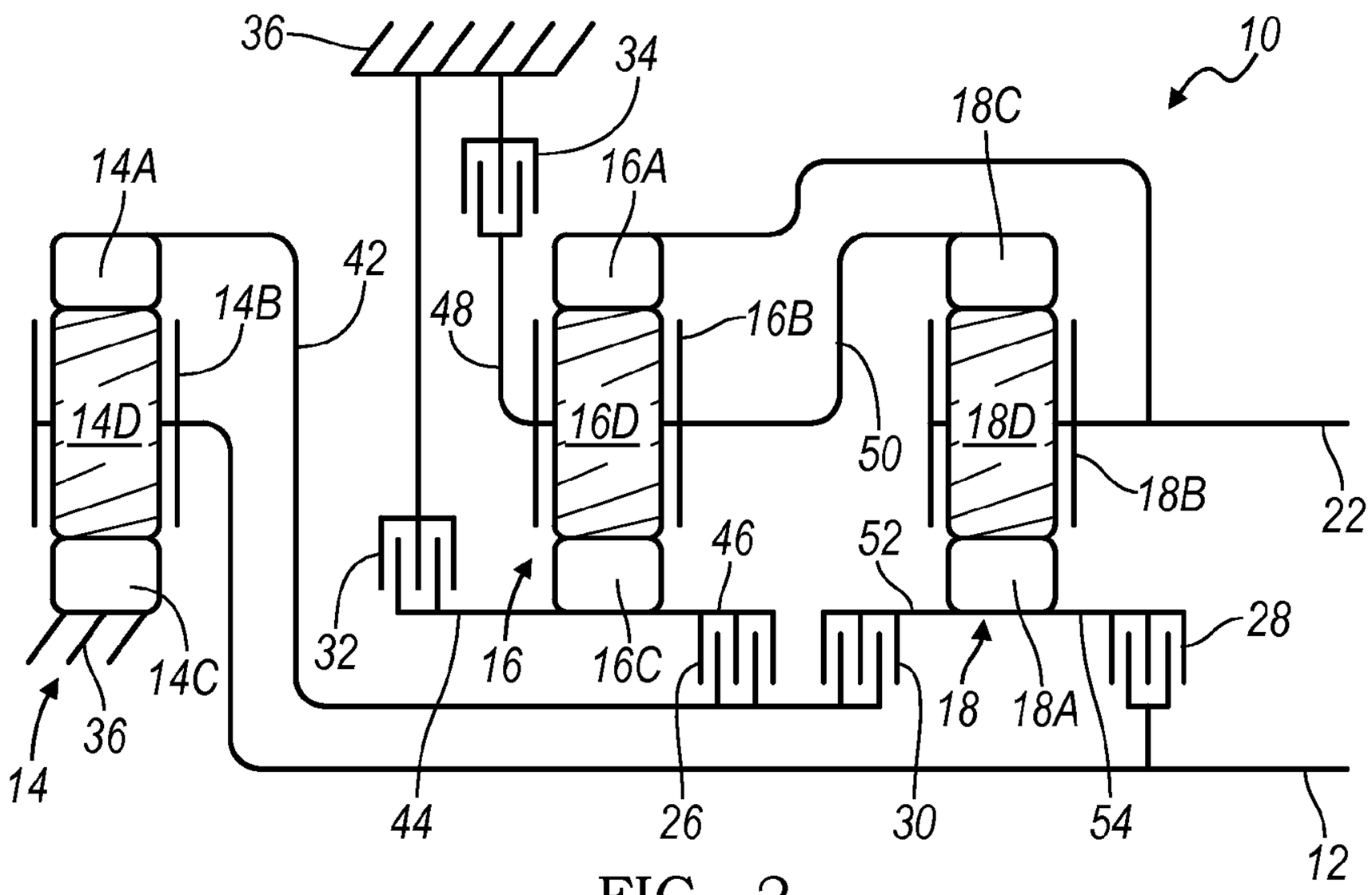
18
18A

FIG. 1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14B
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16B
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16D
18D
50
18B
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32
16
16C
46
52
28
14C
36
18
18A
14
44
26
30
54
12

FIG. 2

GEAR STATE	GEAR RATIO	RATIO STEP	TORQUE TRANSMITTING ELEMENTS				
			32	34	28	26	30
REV	-2.248			X		X	
N		-0.60					
1ST	3.777			X	X		
2ND	2.491	1.52		X			X
3RD	1.630	1.53	X		X		
4TH	1.075	1.52	X				X
5TH	0.834	1.29			X	X	
6TH	0.659	1.26				X	X

X = ON - ENGAGED CARRYING TORQUE
O = ON - ENGAGED NOT CARRYING TORQUE

FIG. 3

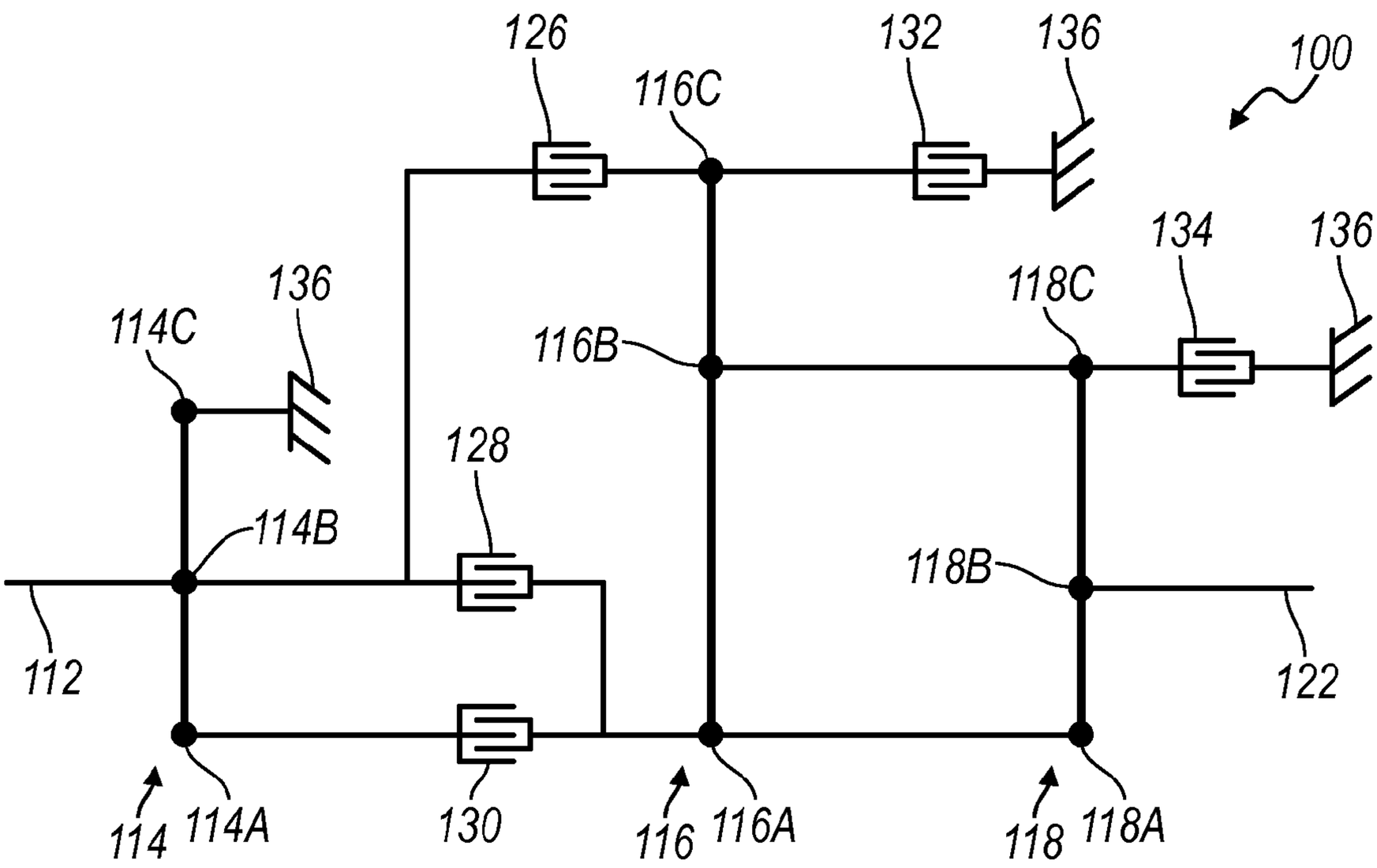


FIG. 4

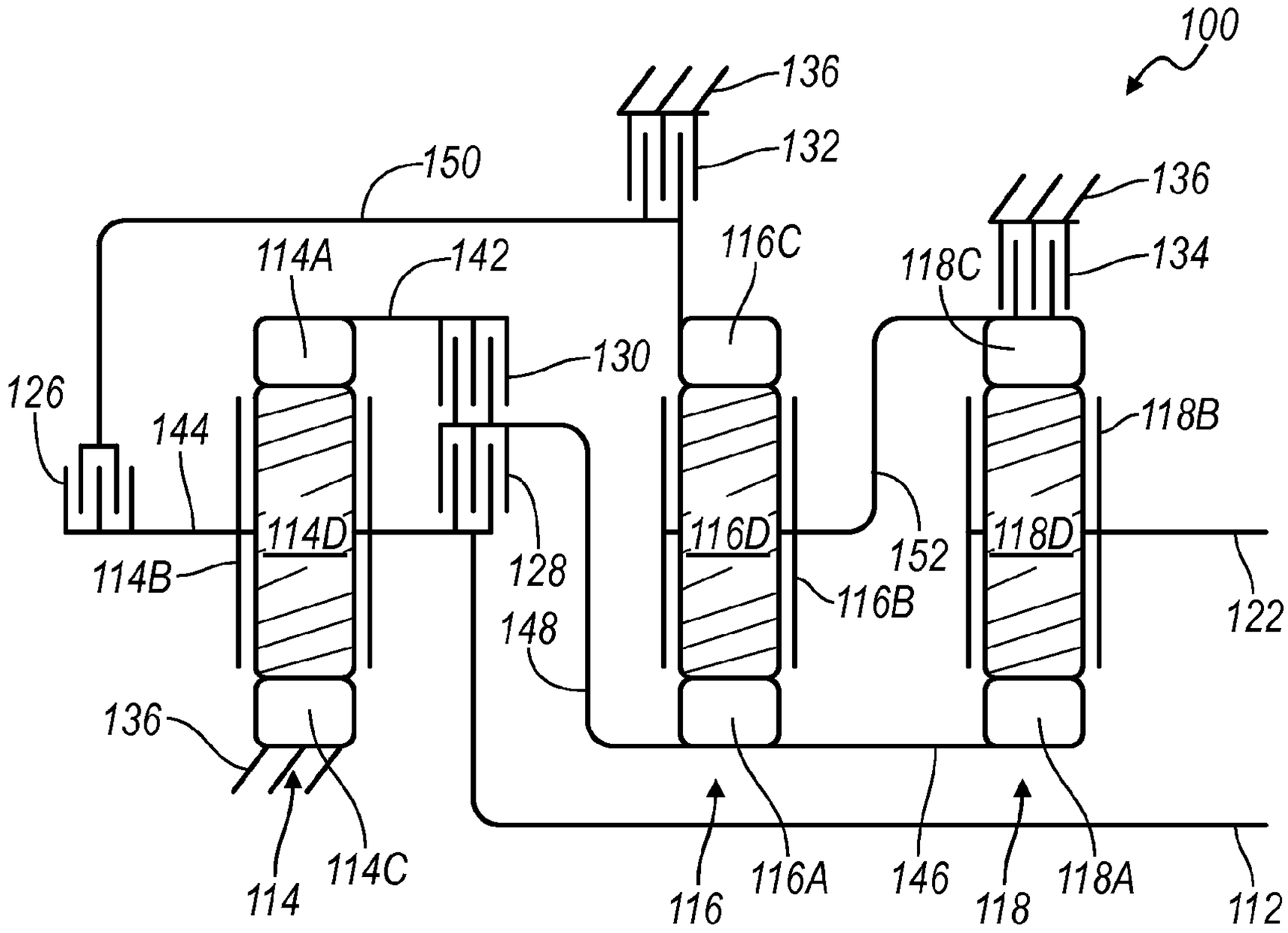
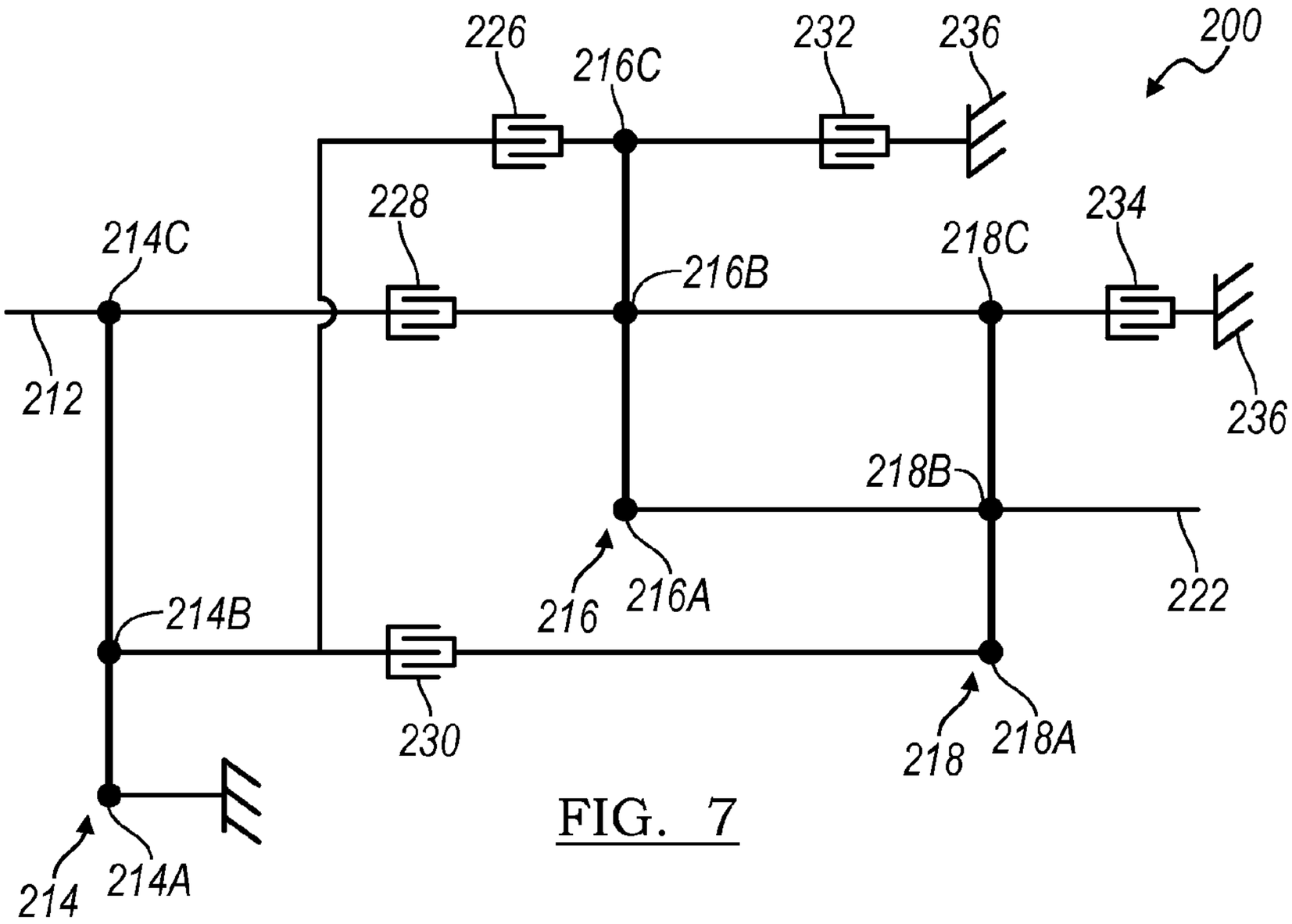


FIG. 5

GEAR STATE	GEAR RATIO	RATIO STEP	TORQUE TRANSMITTING ELEMENTS				
			132	134	126	128	130
REV	-2.213			X	X		
N		-0.49					
1ST	4.495			X		X	
2ND	3.021	1.49		X			X
3RD	2.088	1.45	X			X	
4TH	1.403	1.49	X				X
5TH	1.000	1.40			X	X	
6TH	0.811	1.23			X		X

X = ON - ENGAGED CARRYING TORQUE
O = ON - ENGAGED NOT CARRYING TORQUE

FIG. 6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216C
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200
228
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214C
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216B
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216A
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214B
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218A
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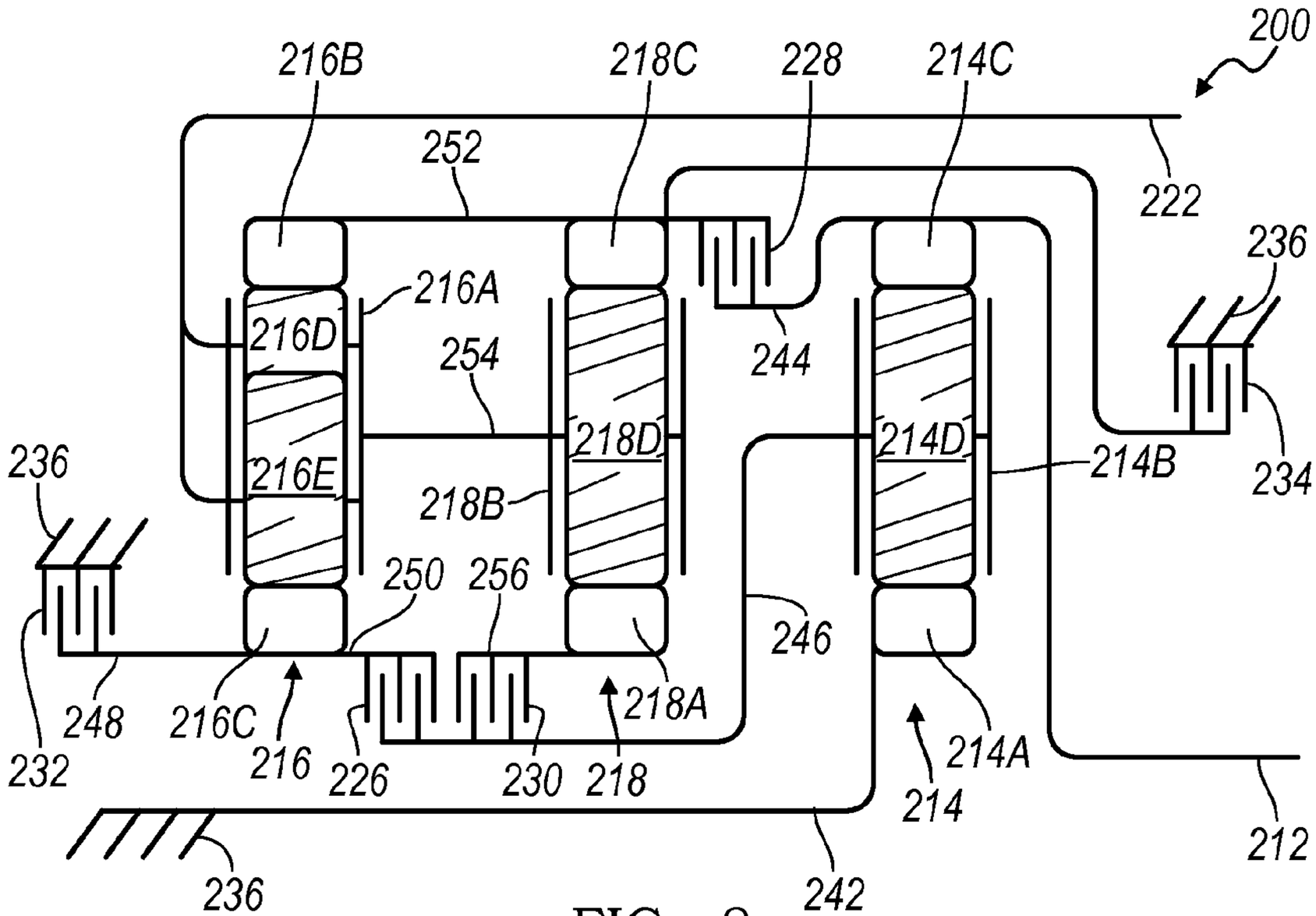
214A

FIG. 7


216B
218C
228
214C
200
252
222
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216A
216D
254
244
218D
214D
214B
234
236
216E
218B
250
256
246
248
216C
218A
232
216
226
230
218
214
214A
212
236
242

FIG. 8

GEAR STATE	GEAR RATIO	RATIO STEP	TORQUE TRANSMITTING ELEMENTS				
			232	234	228	226	230
REV	-3.059			X		X	
N		-0.79					
1ST	3.892			X			X
2ND	2.275	1.71	X				X
3RD	1.488	1.53				X	X
4TH	1.143	1.30			X		X
5TH	0.862	1.33			X	X	
6TH	0.673	1.28	X		X		

X = ON - ENGAGED CARRYING TORQUE
O = ON - ENGAGED NOT CARRYING TORQUE

FIG. 9

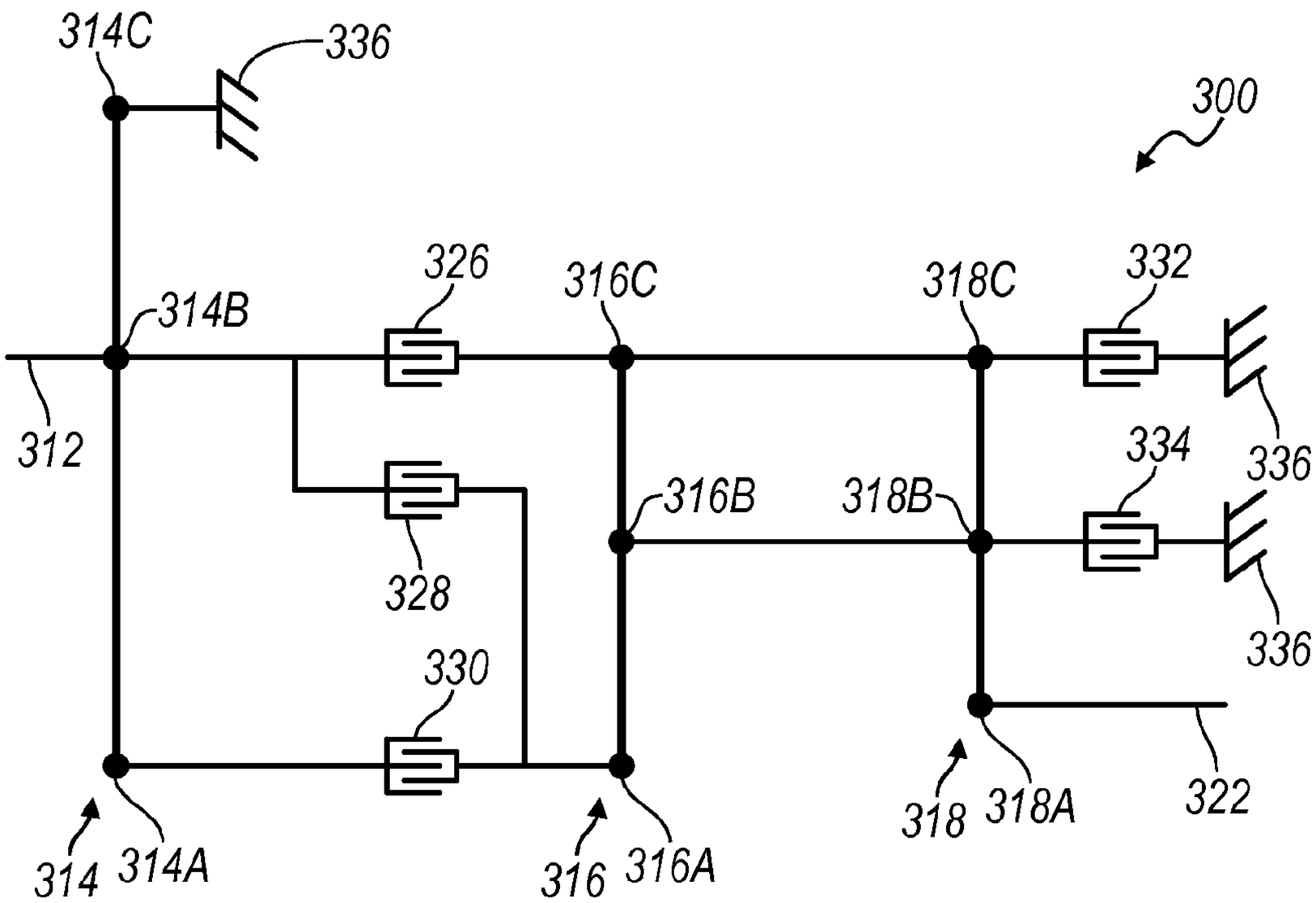


FIG. 10

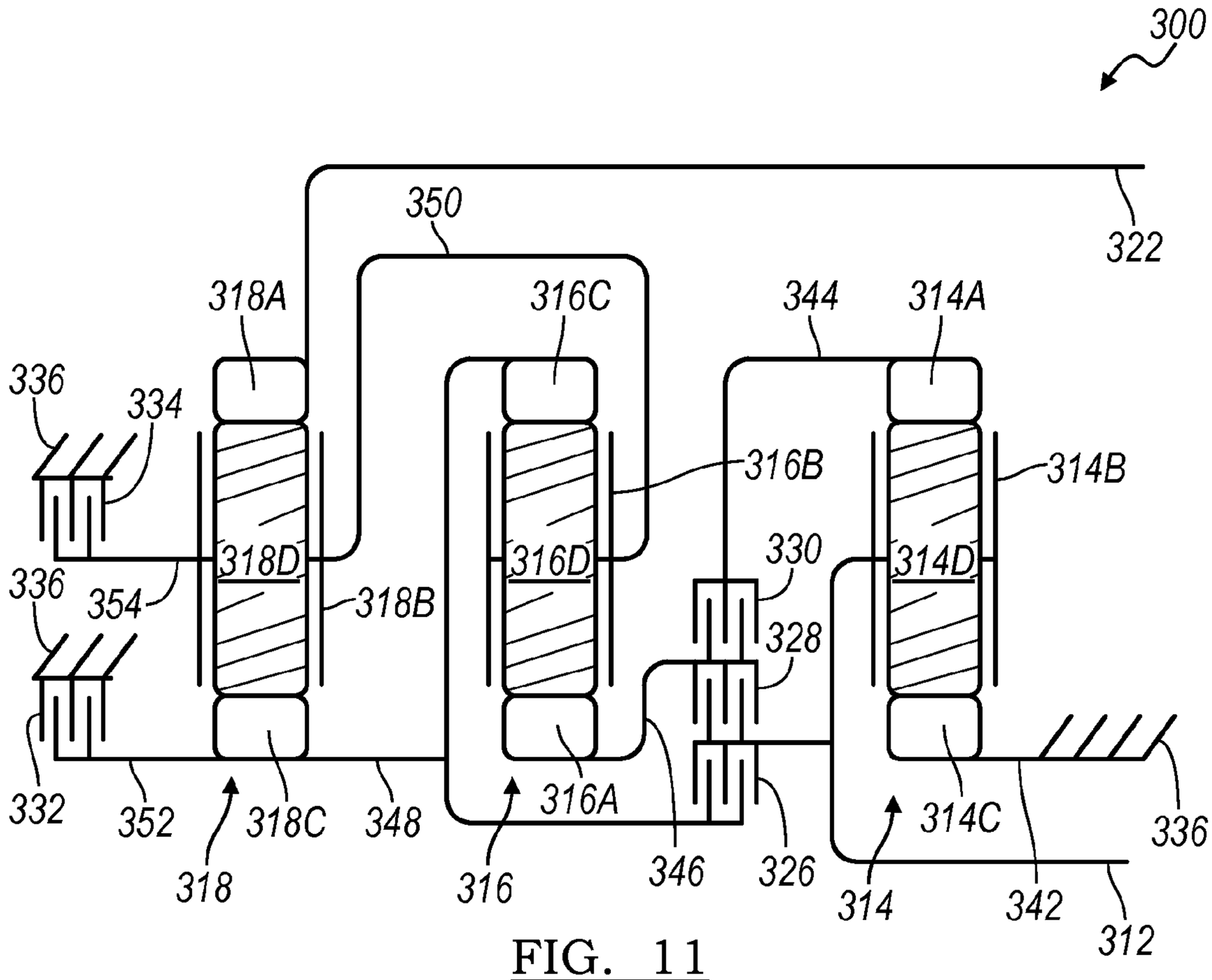
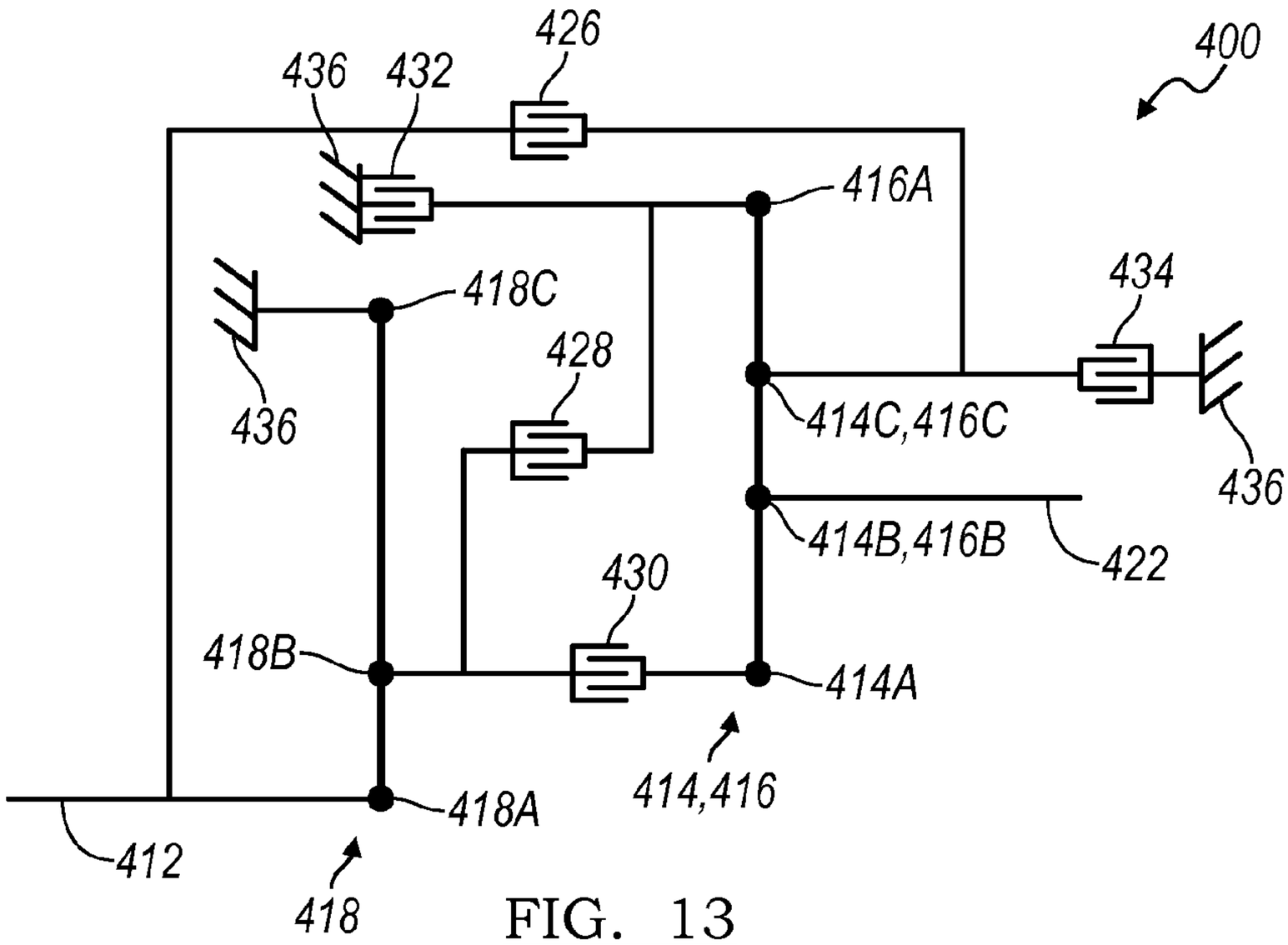


FIG. 11

GEAR STATE	GEAR RATIO	RATIO STEP	TORQUE TRANSMITTING ELEMENTS				
			334	332	328	326	330
REV	-2.300		X			X	
N		-0.56					
1ST	4.140		X		X		
2ND	2.937	1.41	X				X
3RD	1.952	1.50		X	X		
4TH	1.384	1.41		X			X
5TH	1.000	1.38			X	X	
6TH	0.826	1.21				X	X

X = ON - ENGAGED CARRYING TORQUE
O = ON - ENGAGED NOT CARRYING TORQUE

FIG. 12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416A
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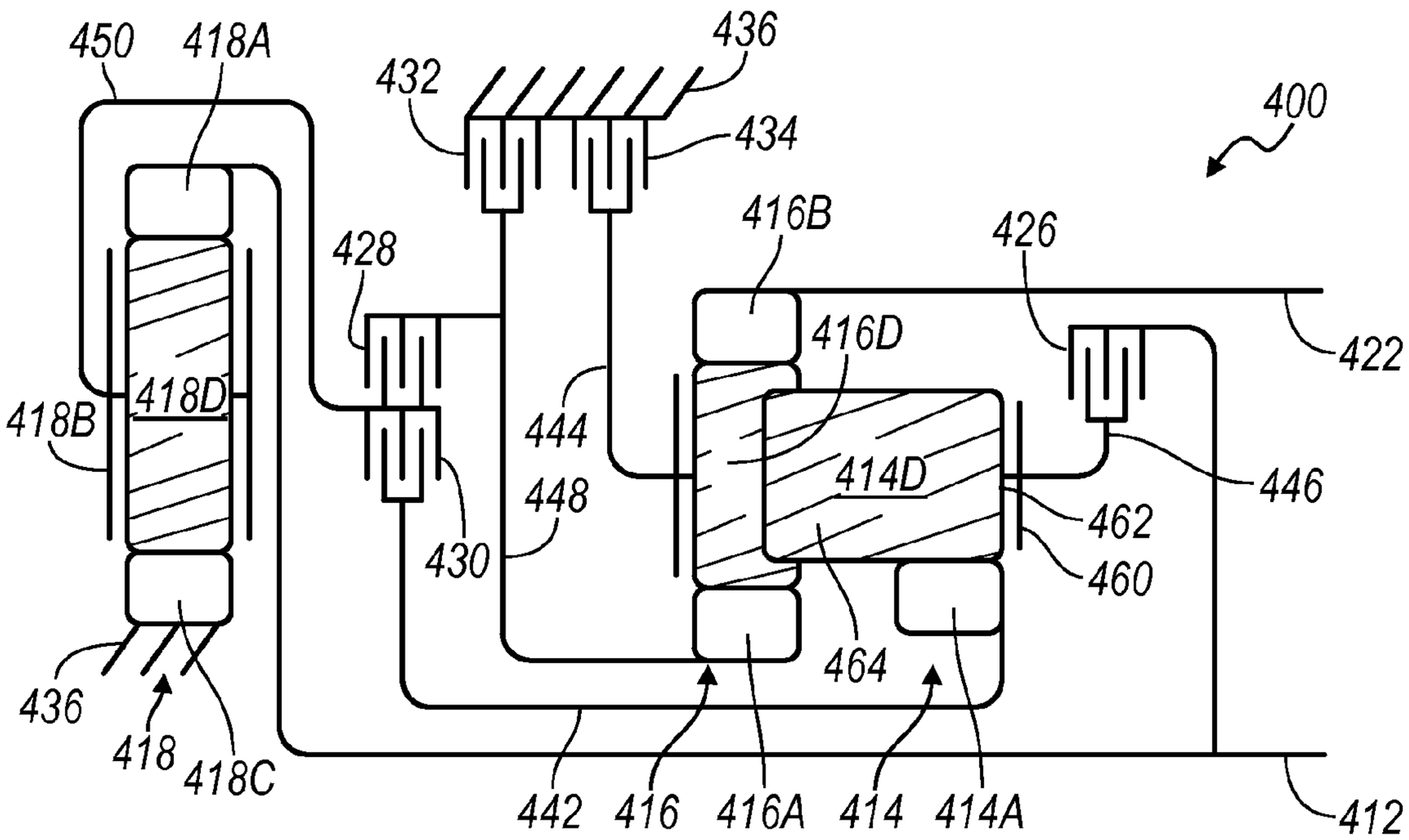
418A
412
418

FIG. 13


450
418A
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416B
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426
416D
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418D
418B
444
414D
446
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462
430
460
464
436
418
418C
442
416
416A
414
414A
412

FIG. 14

GEAR STATE	GEAR RATIO	RATIO STEP	TORQUE TRANSMITTING ELEMENTS				
			430	434	432	428	426
REV	-3.081			X		X	
N		-0.85		O			
1ST	3.636		X	X			
2ND	2.239	1.62	X		X		
3RD	1.541	1.45	X			X	
4TH	1.175	1.31	X				X
5TH	0.851	1.38				X	X
6TH	0.667	1.28			X		X

X = ON - ENGAGED CARRYING TORQUE
O = ON - ENGAGED NOT CARRYING TORQUE

FIG. 15

MULTI-SPEED TRANSMISSION HAVING THREE PLANETARY GEAR SETS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application No. 61/231,605, filed on Aug. 5, 2009, which is hereby incorporated in its entirety herein by reference.

FIELD

The invention relates generally to a multiple speed transmission having a plurality of planetary gear sets and a plurality of torque transmitting devices and more particularly to a transmission having six or more speeds, three planetary gear sets and a plurality of torque transmitting devices.

BACKGROUND

The statements in this section merely provide background information related to the present disclosure and may or may not constitute prior art.

A typical multiple speed transmission uses a combination of friction clutches, planetary gear arrangements and fixed interconnections to achieve a plurality of gear ratios. The number and physical arrangement of the planetary gear sets, generally, are dictated by packaging, cost and desired speed ratios.

While current transmissions achieve their intended purpose, the need for new and improved transmission configurations which exhibit improved performance, especially from the standpoints of efficiency, responsiveness and smoothness and improved packaging, primarily reduced size and weight, is essentially constant. Accordingly, there is a need for an improved, cost-effective, compact multiple speed transmission.

SUMMARY

A transmission is provided having an input member, an output member, three planetary gear sets, a plurality of coupling members and a plurality of torque transmitting devices. Each of the planetary gear sets includes first, second and third members. The torque transmitting devices are for example clutches and brakes.

In one embodiment, a transmission includes an input member, an output member, first, second and third planetary gear sets each having first, second and third members, a first interconnecting member continuously interconnecting the third member of the first planetary gear set with a stationary member, a second interconnecting member continuously interconnecting the second member of the second planetary gear set with the third member of the third planetary gear set, and a third interconnecting member continuously interconnecting the first member of the second planetary gear set with the first member of the third planetary gear set. A first torque transmitting mechanism is selectively engageable to interconnect the second member of the first planetary gear set and the input member with the third member of the second planetary gear set, a second torque transmitting mechanism is selectively engageable to interconnect the second member of the first planetary gear set and the input member with the first member of the second planetary gear set, a third torque transmitting mechanism is selectively engageable to interconnect the first member of the first planetary gear set with the first member of the second planetary gear set and the first member of the third planetary gear set, a fourth torque transmitting mechanism is selectively engageable to interconnect the third member of the second planetary gear set with the stationary member and a fifth torque transmitting mechanism is selectively engageable to interconnect the second member of the second planetary gear set and the third member of the third planetary gear set with the stationary member. The torque transmitting mechanisms are selectively engageable in combinations of at least two to establish at least six forward speed ratios and at least one reverse speed ratio between the input member and the output member.

In another embodiment, a transmission includes an input member, an output member, first, second and third planetary gear sets each having first, second and third members, a first interconnecting member continuously interconnecting the first member of the first planetary gear set with a stationary member, a second interconnecting member continuously interconnecting the second member of the second planetary gear set with the third member of the third planetary gear set, and a third interconnecting member continuously interconnecting the second member of the first planetary gear set with the third member of the second planetary gear set, a second torque transmitting mechanism is selectively engageable to interconnect the third member of the first planetary gear set and the input member with the second member of the second planetary gear set and the third member of the third planetary gear set, a third torque transmitting mechanism is selectively engageable to interconnect the second member of the first planetary gear set with the first member of the third planetary gear set, a fourth torque transmitting mechanism is selectively engageable to interconnect the third member of the second planetary gear set with the stationary member and a fifth torque transmitting mechanism is selectively engageable to interconnect the second member of the second planetary gear set and the third member of the third planetary gear set with the stationary member. The torque transmitting mechanisms are selectively engageable in combinations of at least two to establish at least six forward speed ratios and at least one reverse speed ratio between the input member and the output member.

In another embodiment, a transmission includes an input member, an output member, first, second and third planetary gear sets each having first, second and third members, a first interconnecting member continuously interconnecting the third member of the first planetary gear set with a stationary member, a second interconnecting member continuously interconnecting the second member of the second planetary gear set with the second member of the third planetary gear set, and a third interconnecting member continuously interconnecting the third member of the second planetary gear set with the third member of the third planetary gear set. A first torque transmitting mechanism is selectively engageable to interconnect the second member of the first planetary gear set and the input member with the third member of the second planetary gear set and the third member of the third planetary gear set, a second torque transmitting mechanism is selectively engageable to interconnect the second member of the first planetary gear set and the input member with the first member of the second planetary gear set, a third torque transmitting mechanism is selectively engageable to interconnect the first member of the first planetary gear set with the first member of the second planetary gear set, a fourth torque transmitting mechanism is selectively engageable to interconnect the third member of the second planetary gear set and

the third member of the third planetary gear set with the stationary member, and a fifth torque transmitting mechanism is selectively engageable to interconnect the second member of the second planetary gear set and the second member of the third planetary gear set with the stationary member. The torque transmitting mechanisms are selectively engageable in combinations of at least two to establish at least six forward speed ratios and at least one reverse speed ratio between the input member and the output member.

In another embodiment, a transmission includes an input member, an output member, first, second and third planetary gear sets each having first, second and third members, a first interconnecting member continuously interconnecting the third member of the third planetary gear set with a stationary member, a second interconnecting member continuously interconnecting the second member of the first planetary gear set with the second member of the second planetary gear set, and a third interconnecting member continuously interconnecting the third member of the first planetary gear set with the third member of the second planetary gear set. A first torque transmitting mechanism is selectively engageable to interconnect the first member of the third planetary gear set and the input member with the third member of the second planetary gear set and the third member of the first planetary gear set, a second torque transmitting mechanism is selectively engageable to interconnect the second member of the third planetary gear set with the first member of the second planetary gear set, a third torque transmitting mechanism is selectively engageable to interconnect the second member of the third planetary gear set with the first member of the first planetary gear set, a fourth torque transmitting mechanism is selectively engageable to interconnect the first member of the second planetary gear set with the stationary member and a fifth torque transmitting mechanism is selectively engageable to interconnect the third member of the second planetary gear set and the third member of the first planetary gear set with the stationary member. The torque transmitting mechanisms are selectively engageable in combinations of at least two to establish at least six forward speed ratios and at least one reverse speed ratio between the input member and the output member.

Further features, aspects and advantages of the present invention will become apparent by reference to the following description and appended drawings wherein like reference numbers refer to the same component, element or feature.

DRAWINGS

The drawings described herein are for illustration purposes only and are not intended to limit the scope of the present disclosure in any way.

FIG. **1** is a lever diagram of an embodiment of a six speed transmission according to the present invention;

FIG. **2** is a diagrammatic illustration of an embodiment of a six speed transmission according to the present invention;

FIG. **3** is a truth table presenting the state of engagement of the various torque transmitting elements in each of the available forward and reverse speeds or gear ratios of the transmissions illustrated in FIGS. **1** and **2**;

FIG. **4** is a lever diagram of an embodiment of a six speed transmission according to the present invention;

FIG. **5** is a diagrammatic illustration of an embodiment of a six speed transmission according to the present invention;

FIG. **6** is a truth table presenting the state of engagement of the various torque transmitting elements in each of the available forward and reverse speeds or gear ratios of the transmission illustrated in FIGS. **4** and **5**;

FIG. **7** is a lever diagram of an embodiment of a six speed transmission according to the present invention;

FIG. **8** is a diagrammatic illustration of an embodiment of a six speed transmission according to the present invention;

FIG. **9** is a truth table presenting the state of engagement of the various torque transmitting elements in each of the available forward and reverse speeds or gear ratios of the transmission illustrated in FIGS. **7** and **8**;

FIG. **10** is a lever diagram of an embodiment of a six speed transmission according to the present invention;

FIG. **11** is a diagrammatic illustration of an embodiment of a six speed transmission according to the present invention;

FIG. **12** is a truth table presenting the state of engagement of the various torque transmitting elements in each of the available forward and reverse speeds or gear ratios of the transmission illustrated in FIGS. **10** and **11**;

FIG. **13** is a lever diagram of an embodiment of a six speed transmission according to the present invention;

FIG. **14** is a diagrammatic illustration of an embodiment of a six speed transmission according to the present invention; and

FIG. **15** is a truth table presenting the state of engagement of the various torque transmitting elements in each of the available forward and reverse speeds or gear ratios of the transmission illustrated in FIGS. **13** and **14**.

DETAILED DESCRIPTION

The following description is merely exemplary in nature and is not intended to limit the present disclosure, application, or uses.

At the outset, it should be appreciated that the embodiments of the six speed automatic transmission of the present invention have an arrangement of permanent mechanical connections between the elements of the three planetary gear sets. A third component or element of a first planetary gear set is permanently coupled to a ground. A third component or element of a third planetary gear set is permanently coupled to a second component or element of a second planetary gear set. A second component or element of the third planetary gear set is permanently coupled to a first component or element of the second planetary gear set.

Referring now to FIG. **1**, an embodiment of a six speed transmission **10** is illustrated in a lever diagram format. A lever diagram is a schematic representation of the components of a mechanical device such as an automatic transmission. Each individual lever represents a planetary gear set wherein the three basic mechanical components of the planetary gear are each represented by a node. Therefore, a single lever contains three nodes: one for the sun gear, one for the planet gear carrier, and one for the ring gear. In some cases, two levers may be combined into a single lever having more than three nodes (typically four nodes). For example, if two nodes on two different levers are interconnected through a fixed connection they may be represented as a single node on a single lever. The relative length between the nodes of each lever can be used to represent the ring-to-sun ratio of each respective gear set. These lever ratios, in turn, are used to vary the gear ratios of the transmission in order to achieve an appropriate ratios and ratio progression. Mechanical couplings or interconnections between the nodes of the various planetary gear sets are illustrated by thin, horizontal lines and torque transmitting devices such as clutches and brakes are presented as interleaved fingers. Further explanation of the format, purpose and use of lever diagrams can be found in SAE Paper 810102, "The Lever Analogy: A New Tool in

Transmission Analysis" by Benford and Leising which is hereby fully incorporated by reference.

The transmission **10** includes an input shaft or member **12**, a first planetary gear set **14**, a second planetary gear set **16**, a third planetary gear set **18** and an output shaft or member **22**. The first planetary gear set **14** has three nodes: a first node **14**A, a second node **14**B and a third node **14**C. The second planetary gear set **16** has three nodes: a first node **16**A, a second node **16**B and a third node **16**C. The third planetary gear set **18** has three nodes: a first node **18**A, a second node **18**B and a third node **18**C.

The input member **12** is continuously coupled to the second node **14**B of the first planetary gear set **14**. The output member **22** is coupled to the first node **16**A of the second planetary gear set **16**. The third node **14**C of the first planetary gear set **14** is coupled to a stationary member or transmission housing **36**. The second node **16**B of the second planetary gear set **16** is coupled to the third node **18**C of the third planetary gear set **18**. The first node **16**A of the second planetary gear set **16** is coupled to the second node **18**B of the third planetary gear set **18**.

A first clutch **26** selectively connects the first node **14**A of the first planetary gear set **14** with the third node **16**C of the second planetary gear set **16**. A second clutch **28** selectively connects the input member **12** and the second node **14**B of the first planetary gear set **14** with the first node **18**A of the third planetary gear set **18**. A third clutch **30** selectively connects the first node **14**A of the first planetary gear set **14** with the first node **18**A of the third planetary gear set **18**. A first brake **32** selectively connects the third node **16**C of the second planetary gear set **16** with a stationary member or transmission housing **36**. A second brake **34** selectively connects the second node **16**B of the second planetary gear set **16** with a stationary member or transmission housing **36**.

Referring now to FIG. **2**, a stick diagram presents a schematic layout of the embodiment of the six speed transmission **10** according to the present invention. In FIG. **2**, the numbering from the lever diagram of FIG. **1** is carried over. The clutches and couplings are correspondingly presented whereas the nodes of the planetary gear sets now appear as components of planetary gear sets such as sun gears, ring gears, planet gears and planet gear carriers.

For example, the planetary gear set **14** includes a sun gear member **14**C, a ring gear member **14**A and a planet gear carrier member **14**B that rotatably supports a set of planet gears **14**D (only one of which is shown). The sun gear member **14**C is connected to the stationary member or transmission housing **36** in order to prevent the sun gear member **14**C from rotating relative to the transmission housing **36**. The ring gear member **14**A is connected for common rotation with a first shaft or interconnecting member **42**. The planet carrier member **14**B is connected for common rotation with the input member **12**. The planet gears **14**D are each configured to intermesh with both the sun gear member **14**C and the ring gear member **14**A.

The planetary gear set **16** includes a sun gear member **16**C, a ring gear member **16**A and a planet gear carrier member **16**B that rotatably supports a set of planet gears **16**D (only one of which is shown). The sun gear member **16**C is connected for common rotation with a second shaft or interconnecting member **44** and with a third shaft or interconnecting member **46**. The ring gear member **16**A is connected for common rotation with the output member **22**. The planet carrier member **16**B is connected for common rotation with a fourth shaft or interconnecting member **48** and a fifth shaft or interconnecting member **50**. The planet gears **16**D are each configured to intermesh with both the sun gear member **16**C and the ring gear member **16**A.

The planetary gear set **18** includes a sun gear member **18**A, a ring gear member **18**C and a planet gear carrier member **18**B that rotatably supports a set of planet gears **18**D (only one of which is shown). The sun gear member **18**A is connected for common rotation with a sixth shaft or interconnecting member **52** a seventh shaft or interconnecting member **54**. The ring gear member **18**C is connected for common rotation with the fifth shaft or interconnecting member **50**. The planet carrier member **18**B is connected for common rotation with the output member or shaft **22**. The planet gears **18**D are each configured to intermesh with both the sun gear member **18**A and the ring gear member **18**C.

The input shaft or member **12** is continuously connected to an engine (not shown) or to a turbine of a torque converter (not shown). The output shaft or member **22** is continuously connected with the final drive unit or transfer case (not shown).

The torque-transmitting mechanisms or clutches **26**, **28**, **30** and brakes **32** and **34** allow for selective interconnection of the shafts or interconnecting members, members of the planetary gear sets and the housing. For example, the first clutch **26** is selectively engageable to connect the first shaft or interconnecting member **42** with the third shaft or interconnecting member **46**. The second clutch **28** is selectively engageable to connect the input member **12** with the seventh shaft or interconnecting member **54**. The third clutch **30** is selectively engageable to connect the first shaft or interconnecting member **42** with the sixth shaft or interconnecting member **52**. The first brake **32** is selectively engageable to connect the second shaft or interconnecting member **44** with the stationary element or the transmission housing **36** in order to restrict the member **44** from rotating relative to the transmission housing **36**. The second brake **34** is selectively engageable to connect the fourth shaft or interconnecting member **48** with the stationary element or the transmission housing **36** in order to restrict the member **48** from rotating relative to the transmission housing **36**.

Referring now to FIGS. **2** and **3**, the operation of the embodiment of the six speed transmission **10** will be described. It will be appreciated that transmission **10** are capable of transmitting torque from the input shaft or member **12** to the output shaft or member **22** in at least six forward speed or torque ratios and at least one reverse speed or torque ratio. Each forward and reverse speed or torque ratio is attained by engagement of one or more of the torque-transmitting mechanisms (i.e. first clutch **26**, second clutch **28**, third clutch **30**, first brake **32** and second brake **34**), as will be explained below. FIG. **3** is a truth table presenting the various combinations of torque-transmitting mechanisms that are activated or engaged to achieve the various gear states. An "X" in the box means that the particular clutch or brake is engaged to achieve the desired gear state. An "O" represents that the particular torque transmitting device (i.e. a brake or clutch) is on or active, but not carrying torque. Actual numerical gear ratios of the various gear states are also presented although it should be appreciated that these numerical values are exemplary only and that they may be adjusted over significant ranges to accommodate various applications and operational criteria of the transmission **10**. An example of the gear ratios that may be obtained using the embodiments of the present invention are also shown in FIG. **3**. Of course, other gear ratios are achievable depending on the gear diameter, gear teeth count and gear configuration selected.

To establish a reverse gear, the first clutch **26** and the second brake **34** are engaged or activated. The first clutch **26**

connects the first shaft or interconnecting member **42** with the third shaft or interconnecting member **46**. The second brake **34** connects the fourth shaft or interconnecting member **48** with the stationary element or the transmission housing **36** in order to restrict the member **48** from rotating relative to the transmission housing **36**. Likewise, the six forward ratios are achieved through different combinations of clutch and brake engagement, as shown in FIG. **3**.

It will be appreciated that the foregoing explanation of operation and gear states of the six speed transmission **10** assumes, first of all, that all the clutches not specifically referenced in a given gear state are inactive or disengaged and, second of all, that during gear shifts, i.e., changes of gear state, between at least adjacent gear states, a clutch engaged or activated in both gear states will remain engaged or activated.

Referring now to FIG. **4**, another embodiment of a six speed transmission **100** is illustrated in a lever diagram format. The transmission **100** includes an input shaft or member **112**, a first planetary gear set **114**, a second planetary gear set **116**, a third planetary gear set **118** and an output shaft or member **122**. The first planetary gear set **114** has three nodes: a first node **114**A, a second node **114**B, and a third node **114**C. The second planetary gear set **116** has three nodes: a first node **116**A, a second node **116**B, and a third node **116**C. The third planetary gear set **118** has three nodes: a first node **118**A, a second node **118**B and a third node **118**C.

The input member **112** is continuously coupled to the second node **114**B of the first planetary gear set **114**. The output member **122** is coupled to the second node **118**B of the third planetary gear set **118**. The third node **114**C of the first planetary gear set **114** is coupled to a stationary member or a transmission housing **136**. The second node **116**B of the second planetary gear set **116** is coupled to the third node **118**C of the third planetary gear set **118**. The first node **118**A of the third planetary gear set **118** is coupled to the first node **116**A of the second planetary gear set **116**.

A first clutch **126** selectively connects the second node **114**B of the first planetary gear set **114** with the third node **116**C of the second planetary gear set **116**. A second clutch **128** selectively connects the second node **114**B of the first planetary gear set **114** with the first node **116**A of the second planetary gear set **116** and the first node **118**A of the third planetary gear set **118**. A third clutch **130** selectively connects the first node **114**A of the first planetary gear set **114** with the first node **116**A of the second planetary gear set **116** and the first node **118**A of the third planetary gear set **118**. A first brake **132** selectively connects the third node **116**C of the second planetary gear set **116** with a stationary member or transmission housing **136**. A second brake **134** selectively connects the third node **118**C of the third planetary gear set **118** and the second node **116**B of the second planetary gear set **116** with a stationary member or transmission housing **136**.

Referring now to FIG. **5**, a stick diagram presents a schematic layout of the embodiment of the six speed transmission **100** according to the present invention. In FIG. **5**, the numbering from the lever diagram of FIG. **4** is carried over. The clutches and couplings are correspondingly presented whereas the nodes of the planetary gear sets now appear as components of planetary gear sets such as sun gears, ring gears, planet gears and planet gear carriers.

For example, the planetary gear set **114** includes a sun gear member **114**C, a ring gear member **114**A and a planet gear carrier member **114**B that rotatably supports a set of planet gears **114**D (only one of which is shown). The sun gear member **114**C is connected for common rotation the stationary member or transmission housing **136** in order to prevent the sun gear member **114**C from rotating relative to the transmission housing **136**. The ring gear member **114**A is connected for common rotation with a first shaft or interconnecting member **142**. The planet carrier member **114**B is connected for common rotation with a second shaft or interconnecting member **144** and the input member **112**. The planet gears **114**D are each configured to intermesh with both the sun gear member **114**C and the ring gear member **114**A.

The planetary gear set **116** includes a sun gear member **116**A, a ring gear member **116**C and a planet gear carrier member **116**B that rotatably supports a set of planet gears **116**D (only one of which is shown). The sun gear member **116**A is connected for common rotation with a third shaft or interconnecting member **146** and a fourth shaft or interconnecting member **148**. The ring gear member **116**C is connected for common rotation with a fifth shaft or interconnecting member **150**. The planet carrier member **116**B is connected for common rotation with a sixth shaft or interconnecting member **152**. The planet gears **116**D are each configured to intermesh with both the sun gear member **116**A and the ring gear member **116**C.

The planetary gear set **118** includes a sun gear member **118**A, a ring gear member **118**C and a planet gear carrier member **118**B that rotatably supports a set of planet gears **118**D (only one of which is shown). The sun gear member **118**A is connected for common rotation with the third shaft or interconnecting member **146**. The ring gear member **118**C is connected for common rotation with the sixth shaft or interconnecting member **152**. The planet carrier member **118**B is connected for common rotation with the output member **122**. The planet gears **118**D are each configured to intermesh with both the sun gear member **118**A and the ring gear member **118**C.

The input shaft or member **112** is continuously connected to an engine (not shown) or to a turbine of a torque converter (not shown). The output shaft or member **122** is continuously connected with the final drive unit or transfer case (not shown).

The torque-transmitting mechanisms or clutches **126**, **128**, and **130** and brakes **132** and **134** allow for selective interconnection of the shafts or interconnecting members, members of the planetary gear sets and the housing. For example, the first clutch **126** is selectively engageable to connect the second shaft or interconnecting member **144** with the fifth shaft or interconnecting member **150**. The second clutch **128** is selectively engageable to connect the fourth shaft or interconnecting member **148** with the input shaft or member **112**. The third clutch **130** is selectively engageable to connect the first shaft or interconnecting member **142** with the fourth shaft or interconnecting member **148**. The first brake **132** is selectively engageable to connect the fifth shaft or interconnecting member **150** with the stationary element or the transmission housing **136** in order to restrict the member **150** from rotating relative to the transmission housing **136**. The second brake **134** is selectively engageable to connect the sixth shaft or interconnecting member **152** with the stationary element or the transmission housing **136** in order to restrict the member **152** from rotating relative to the transmission housing **136**.

Referring now to FIG. **5** and FIG. **6**, the operation of the embodiment of the six speed transmission **100** will be described. It will be appreciated that transmission **100** is capable of transmitting torque from the input shaft or member **112** to the output shaft or member **122** in at least six forward speed or torque ratios and at least one reverse speed or torque ratio. Each forward and reverse speed or torque ratio is attained by engagement of one or more of the torque-trans-

mitting mechanisms (i.e. first clutch **126**, second clutch **128**, third clutch **130**, first brake **132**, and second brake **134**), as will be explained below. FIG. **6** is a truth table presenting the various combinations of torque-transmitting mechanisms that are activated or engaged to achieve the various gear states. An "X" in the box means that the particular clutch or brake is engaged to achieve the desired gear state. An "O" represents that the particular torque transmitting device (i.e. a brake or clutch) is on or active, but not carrying torque. Actual numerical gear ratios of the various gear states are also presented although it should be appreciated that these numerical values are exemplary only and that they may be adjusted over significant ranges to accommodate various applications and operational criteria of the transmission **100**. An example of the gear ratios that may be obtained using the embodiments of the present invention are also shown in FIG. **6**. Of course, other gear ratios are achievable depending on the gear diameter, gear teeth count and gear configuration selected.

To establish a reverse gear, the first clutch **126** and the second brake **134** are engaged or activated. The first clutch **126** connects the second shaft or interconnecting member **144** with the fifth shaft or interconnecting member **150**. The second brake **134** connects the sixth shaft or interconnecting member **152** with the stationary element or the transmission housing **136** in order to restrict the member **152** from rotating relative to the transmission housing **136**. Likewise, the six forward ratios are achieved through different combinations of clutch and brake engagement, as shown in FIG. **6**.

It will be appreciated that the foregoing explanation of operation and gear states of the six speed transmission **100** assumes, first of all, that all the clutches not specifically referenced in a given gear state are inactive or disengaged and, second of all, that during gear shifts, i.e., changes of gear state, between at least adjacent gear states, a clutch engaged or activated in both gear states will remain engaged or activated.

Referring now to FIG. **7**, another embodiment of a six speed transmission **200** is illustrated in a lever diagram format. The transmission **200** includes an input shaft or member **212**, a first planetary gear set **214**, a second planetary gear set **216**, a third planetary gear set **218** and an output shaft or member **222**. The first planetary gear set **214** has three nodes: a first node **214**A, a second node **214**B, and a third node **214**C. The second planetary gear set **216** has three nodes: a first node **216**A, a second node **216**B, and a third node **216**C. The third planetary gear set **218** has three nodes: a first node **218**A, a second node **218**B and a third node **218**C.

The input member **212** is continuously coupled to the third node **214**C of the first planetary gear set **214**. The output member **222** is coupled to the second node **218**B of the third planetary gear set **218**. The second node **216**B of the second planetary gear set **216** is coupled to the third node **218**C of the third planetary gear set **218**. The first node **216**A of the second planetary gear set **216** is coupled to the second node **218**B of the third planetary gear set **218**. The first node **214**A of the first planetary gear set **214** is coupled to a stationary member or a transmission housing **236**.

A first clutch **226** selectively connects the second node **214**B of the first planetary gear set **214** with the third node **216**C of the second planetary gear set **216**. A second clutch **228** selectively connects the third node **214**C of the first planetary gear set **214** and the input member **212** with the third node **218**C of the third planetary gear set **218** and the second node **216**B of the second planetary gear set **216**. A third clutch **230** selectively connects the second node **214**B of the first planetary gear set **214** with the first node **218**A of the third planetary gear set **218**. A first brake **232** selectively connects the third node **216**C of the second planetary gear set **216** with a stationary member or transmission housing **236**. A second brake **234** selectively connects the second node **216**B of the second planetary gear set **216** and the third node **218**C of the third planetary gear set **218** with a stationary member or transmission housing **236**.

Referring now to FIG. **8**, a stick diagram presents a schematic layout of the embodiment of the six speed transmission **200** according to the present invention. In FIG. **8**, the numbering from the lever diagram of FIG. **7** is carried over. The clutches and couplings are correspondingly presented whereas the nodes of the planetary gear sets now appear as components of planetary gear sets such as sun gears, ring gears, planet gears and planet gear carriers.

For example, the planetary gear set **214** includes a sun gear member **214**A, a ring gear member **214**C and a planet gear carrier member **214**B that rotatably supports a set of planet gears **214**D (only one of which is shown). The sun gear member **214**A is connected for common rotation with a first shaft or interconnecting member **242**. The ring gear member **214**C is connected for common rotation with a second shaft or interconnecting member **244** and the input member **212**. The planet carrier member **214**B is connected for common rotation with a third shaft or interconnecting member **246**. The planet gears **214**D are each configured to intermesh with both the sun gear member **214**A and the ring gear member **214**C.

The planetary gear set **216** includes a sun gear member **216**C, a ring gear member **216**B and a planet gear carrier member **216**A that rotatably supports a set of planet gears **216**D (only one of which is shown) and a set of planet gears **216**E (only one of which is shown). The sun gear member **216**C is connected for common rotation with a fourth shaft or interconnecting member **248** and a fifth shaft or interconnecting member **250**. The ring gear member **216**B is connected for common rotation with a sixth shaft or interconnecting member **252**. It should be appreciated that the sixth member **252** may be broken up into several separate connected members without departing from the scope of the present invention. The planet carrier member **216**A is connected for common rotation with a seventh shaft or interconnecting member **254** and the output member **222**. The planet gears **216**D are each configured to intermesh with both the planet gears **216**E and the ring gear member **216**B. The planet gears **216**E are configured each to intermesh with both the planet gears **216**D and the sun gear member **216**C.

The planetary gear set **218** includes a sun gear member **218**A, a ring gear member **218**C and a planet gear carrier member **218**B that rotatably supports a set of planet gears **218**D (only one of which is shown). The sun gear member **218**A is connected for common rotation with an eighth shaft or interconnecting member **256**. The ring gear member **218**C is connected for common rotation with the sixth shaft or interconnecting member **252**. The planet carrier member **218**B is connected for common rotation with the seventh shaft or interconnecting member **254**. The planet gears **218**D are each configured to intermesh with both the sun gear member **218**A and the ring gear member **218**C.

The input shaft or member **212** is continuously connected to an engine (not shown) or to a turbine of a torque converter (not shown). The output shaft or member **222** is continuously connected with the final drive unit or transfer case (not shown).

The torque-transmitting mechanisms or clutches **226**, **228** and **230** and brakes **232** and **234** allow for selective interconnection of the shafts or interconnecting members, members of the planetary gear sets and the housing. For example, the first clutch **226** is selectively engageable to connect the third shaft

or interconnecting member **246** with the fifth shaft or interconnecting member **250**. The second clutch **228** is selectively engageable to connect the sixth shaft or interconnecting member **252** with the second shaft or interconnecting member **244** and the input member **212**. The third clutch **230** is selectively engageable to connect the third shaft or interconnecting member **246** with the eighth shaft or interconnecting member **256**. The first brake **232** is selectively engageable to connect the fourth shaft or interconnecting member **248** with the stationary element or the transmission housing **236** in order to restrict the member **248** from rotating relative to the transmission housing **236**. The second brake **234** is selectively engageable to connect the sixth shaft or interconnecting member **252** with the stationary element or the transmission housing **236** in order to restrict the member **252** from rotating relative to the transmission housing **236**.

Referring now to FIG. **8** and FIG. **9**, the operation of the embodiment of the six speed transmission **200** will be described. It will be appreciated that transmission **200** is capable of transmitting torque from the input shaft or member **212** to the output shaft or member **222** in at least six forward speed or torque ratios and at least one reverse speed or torque ratio. Each forward and reverse speed or torque ratio is attained by engagement of one or more of the torque-transmitting mechanisms (i.e. first clutch **226**, second clutch **228**, third clutch **230**, first brake **232** and second brake **234**), as will be explained below. FIG. **9** is a truth table presenting the various combinations of torque-transmitting mechanisms that are activated or engaged to achieve the various gear states. An "X" in the box means that the particular clutch or brake is engaged to achieve the desired gear state. An "O" represents that the particular torque transmitting device (i.e. a brake or clutch) is on or active, but not carrying torque. Actual numerical gear ratios of the various gear states are also presented although it should be appreciated that these numerical values are exemplary only and that they may be adjusted over significant ranges to accommodate various applications and operational criteria of the transmission **200**. An example of the gear ratios that may be obtained using the embodiments of the present invention are also shown in FIG. **9**. Of course, other gear ratios are achievable depending on the gear diameter, gear teeth count and gear configuration selected.

To establish a reverse gear, the first clutch **226** and the second brake **234** are engaged or activated. The first clutch **226** connects the third shaft or interconnecting member **246** with the fifth shaft or interconnecting member **250**. The second brake **234** connects the sixth shaft or interconnecting member **252** with the stationary element or the transmission housing **236** in order to restrict the member **252** from rotating relative to the transmission housing **236**. Likewise, the six forward ratios are achieved through different combinations of clutch and brake engagement, as shown in FIG. **9**.

It will be appreciated that the foregoing explanation of operation and gear states of the six speed transmission **200** assumes, first of all, that all the clutches not specifically referenced in a given gear state are inactive or disengaged and, second of all, that during gear shifts, i.e., changes of gear state, between at least adjacent gear states, a clutch engaged or activated in both gear states will remain engaged or activated.

Referring now to FIG. **10**, another embodiment of a six speed transmission **300** is illustrated in a lever diagram format. The transmission **300** includes an input shaft or member **312**, a first planetary gear set **314**, a second planetary gear set **316**, a third planetary gear set **318** and an output shaft or member **322**. The first planetary gear set **314** has three nodes: a first node **314**A, a second node **314**B and a third node **314**C. The second planetary gear set **316** has three nodes: a first node **316**A, a second node **316**B and a third node **316**C. The third planetary gear set **318** has three nodes: a first node **318**A, a second node **318**B and a third node **318**C.

The input member **312** is continuously coupled to the second node **314**B of the first planetary gear set **314**. The output member **322** is coupled to the first node **318**A of the third planetary gear set **318**. The third node **316**C of the second planetary gear set **316** is coupled to the third node **318**C of the third planetary gear set **318**. The second node **316**B of the second planetary gear set **316** is coupled to the second node **318**B of the third planetary gear set **318**. The third node **314**C of the first planetary gear set **314** is coupled to a stationary member or a transmission housing **336**.

A first clutch **326** selectively connects the input member **312** and the second node **314**B of the first planetary gear set **314** with the third node **316**C of the second planetary gear set **316** and the third node **318**C of the third planetary gear set **318**. A second clutch **328** selectively connects the input member **314** and the second node **314**B of the first planetary gear set **314** with the first node **316**A of the second planetary gear set **316**. A third clutch **330** selectively connects the first node **314**A of the first planetary gear set **314** with the first node **316**A of the second planetary gear set **316**. A first brake **332** selectively connects the third node **316**C of the second planetary gear set **316** and the third node **318**C of the third planetary gear set **318** with a stationary member or transmission housing **336**. A second brake **334** selectively connects the second node **316**B of the second planetary gear set **316** and the second node **318**B of the third planetary gear set **318** with a stationary member or transmission housing **336**.

Referring now to FIG. **11**, a stick diagram presents a schematic layout of the embodiment of the six speed transmission **300** according to the present invention. In FIG. **11**, the numbering from the lever diagram of FIG. **10** is carried over. The clutches and couplings are correspondingly presented whereas the nodes of the planetary gear sets now appear as components of planetary gear sets such as sun gears, ring gears, planet gears and planet gear carriers.

For example, the planetary gear set **314** includes a sun gear member **314**C, a ring gear member **314**A and a planet gear carrier member **314**B that rotatably supports a set of planet gears **314**D (only one of which is shown). The sun gear member **314**C is connected for common rotation with a first shaft or interconnecting member **342**. The ring gear member **314**A is connected for common rotation with a second shaft or interconnecting member **344**. The planet carrier member **314**B is connected for common rotation with the input member **312**. The planet gears **314**D are each configured to intermesh with both the sun gear member **314**C and the ring gear member **314**A.

The planetary gear set **316** includes a sun gear member **316**A, a ring gear member **316**C and a planet gear carrier member **316**B that rotatably supports a set of planet gears **316**D (only one of which is shown). The sun gear member **316**A is connected for common rotation with a third shaft or interconnecting member **346**. The ring gear member **316**C is connected for common rotation with a fourth shaft or interconnecting member **348**. The planet carrier member **316**B is connected for common rotation with a fifth shaft or interconnecting member **350**. The planet gears **316**D are each configured to intermesh with both the sun gear member **316**A and the ring gear member **316**C.

The planetary gear set **318** includes a sun gear member **318**C, a ring gear member **318**A and a planet gear carrier member **318**B that rotatably supports a set of planet gears **318**D (only one of which is shown). The sun gear member

318C is connected for common rotation with a sixth shaft or interconnecting member **352** and the fourth shaft or interconnecting member **348**. The ring gear member **318**A is connected for common rotation with the output member **322**. The planet carrier member **318**B is connected for common rotation with a seventh shaft or interconnecting member **354** and with the fifth shaft or interconnecting member **350**. The planet gears **318**D are each configured to intermesh with both the sun gear member **318**C and the ring gear member **318**A.

The input shaft or member **312** is continuously connected to an engine (not shown) or to a turbine of a torque converter (not shown). The output shaft or member **322** is continuously connected with the final drive unit or transfer case (not shown).

The torque-transmitting mechanisms or clutches **326**, **328**, **330** and brakes **332** and **334** allow for selective interconnection of the shafts or interconnecting members, members of the planetary gear sets and the housing. For example, the first clutch **326** is selectively engageable to connect the input member **312** with the fourth shaft or interconnecting member **348**. The second clutch **328** is selectively engageable to connect the third shaft or interconnecting member **346** with the input member **312**. The third clutch **330** is selectively engageable to connect the third shaft or interconnecting member **346** with the second shaft or interconnecting member **344**. The first brake **332** is selectively engageable to connect the sixth shaft or interconnecting member **352** with the stationary element or the transmission housing **336** in order to restrict the member **352** from rotating relative to the transmission housing **336**. The second brake **334** is selectively engageable to connect the seventh shaft or interconnecting member **354** and the fifth shaft or interconnecting member **350** with the stationary element or the transmission housing **336** in order to restrict the members **354**, **350** from rotating relative to the transmission housing **336**.

Referring now to FIGS. **11** and **12**, the operation of the embodiment of the six speed transmission **300** will be described. It will be appreciated that transmission **300** is capable of transmitting torque from the input shaft or member **312** to the output shaft or member **322** in at least six forward speed or torque ratios and at least one reverse speed or torque ratio. Each forward and reverse speed or torque ratio is attained by engagement of one or more of the torque-transmitting mechanisms (i.e. first clutch **326**, second clutch **328**, third clutch **330**, first brake **332** and second brake **334**), as will be explained below. FIG. **12** is a truth table presenting the various combinations of torque-transmitting mechanisms that are activated or engaged to achieve the various gear states. An "X" in the box means that the particular clutch or brake is engaged to achieve the desired gear state. Actual numerical gear ratios of the various gear states are also presented although it should be appreciated that these numerical values are exemplary only and that they may be adjusted over significant ranges to accommodate various applications and operational criteria of the transmission **300**. An example of the gear ratios that may be obtained using the embodiments of the present invention are also shown in FIG. **12**. Of course, other gear ratios are achievable depending on the gear diameter, gear teeth count and gear configuration selected.

To establish a reverse gear, the first clutch **326** and the second brake **334** are engaged or activated. The first clutch **326** connects the input member **312** with the fourth shaft or interconnecting member **348**. The second brake **334** connects the seventh shaft or interconnecting member **354** and the fifth shaft or interconnecting member **350** with the stationary element or the transmission housing **336** in order to restrict the members **354**, **350** from rotating relative to the transmission housing **336**. Likewise, the six forward ratios are achieved through different combinations of clutch and brake engagement, as shown in FIG. **12**.

It will be appreciated that the foregoing explanation of operation and gear states of the six speed transmission **300** assumes, first of all, that all the clutches not specifically referenced in a given gear state are inactive or disengaged and, second of all, that during gear shifts, i.e., changes of gear state, between at least adjacent gear states, a clutch engaged or activated in both gear states will remain engaged or activated.

Referring now to FIG. **14**, another embodiment of a six speed transmission **400** is illustrated in a lever diagram format. The transmission **400** includes an input shaft or member **412**, a first planetary gear set **414**, a second planetary gear set **416**, a third planetary gear set **418** and an output shaft or member **422**. The first and second planetary gear sets **414**, **416** are represented by a single lever sharing common node points. The first planetary gear set **414** has three nodes: a first node **414**A, a second node **414**B and a third node **414**C. The second planetary gear set **416** has three nodes: a first node **416**A, a second node **416**B and a third node **416**C. The third planetary gear set **418** has three nodes: a first node **418**A, a second node **418**B and a third node **418**C.

The input member **412** is continuously coupled to the first node **418**A of the third planetary gear set **418**. The output member **422** is coupled to the second node **414**B of the first planetary gear set **414** and to the second node **416**B of the second planetary gear set **416**. The third node **418**C of the third planetary gear set **418** is coupled to a stationary member or a transmission housing **436**. The second node **416**B of the second planetary gear set **416** is coupled to the second node **414**B of the first planetary gear set **414**. The third node **414**C of the first planetary gear set **414** is coupled to the third node **416**C of the second planetary gear set **416**.

A first clutch **426** selectively connects the input member **412** and the first node **418**A of the third planetary gear set **418** with the third node **416**C of the second planetary gear set **416** and the third node **414**C of the first planetary gear set **414**. A second clutch **428** selectively connects the second node **418**B of the third planetary gear set **418** with the first node **416**A of the second planetary gear set **416**. A third clutch **430** selectively connects the second node **418**B of the third planetary gear set **418** with the first node **414**A of the first planetary gear set **414**. A first brake **432** selectively connects the first node **416**A of the second planetary gear set **416** with a stationary member or transmission housing **436**. A second brake **434** selectively connects the third node **416**C of the second planetary gear set **416** and the third node **414**C of the first planetary gear set **414** with a stationary member or transmission housing **436**.

Referring now to FIG. **14**, a stick diagram presents a schematic layout of the embodiment of the six speed transmission **400** according to the present invention. In FIG. **14**, the numbering from the lever diagram of FIG. **13** is carried over. The clutches and couplings are correspondingly presented whereas the nodes of the planetary gear sets now appear as components of planetary gear sets such as sun gears, ring gears, planet gears and planet gear carriers.

The planetary gear sets **414** and **416** are a combined, or Ravigneaux, gear set. The planetary gear set **414** includes a sun gear member **414**A and the planetary gear set **416** includes a sun gear member **416**A and a ring gear member **416**B. The planetary gear sets **414** and **416** share a common planet gear carrier member **460**. The planetary carrier **460** is formed by combining the planet carrier member **414**C of the first planetary gear set **414** and the planet carrier member

416C of the second planetary gear set **416** into a single planetary carrier **460**. The planetary carrier member **460** rotatably supports a first set of planet gears **414**D (only one of which is shown) and a second set of planet gears **416**D (only one of which is shown). In addition, the first planetary gear set **414** does not include a separate ring gear. Instead, the planetary gear set **414** "uses", effectively, the ring gear **416**B of the second planetary gear set **416** through the meshing relationship of a first and a second set of planet gears **414**D and **416**D, the sun gear **414**A and ring gear **416**B.

The sun gear member **414**A is connected for common rotation with a first shaft or interconnecting member **442**. The planetary carrier member **460** is connected for common rotation with a second shaft or interconnecting member **444** and a third shaft or interconnecting member **446**. The sun gear member **416**A is connected for common rotation with a fourth shaft or interconnecting member **448**. The ring gear member **416**B is connected for common rotation with the output member **422**. The first set of planet gears **414**D each are configured to intermesh the sun gear member **414**A at a first end **462** of the planet gears **414**D and each are configured to intermesh with the planet gears **416**D at a second end **464** of the planet gears **414**D. The second set of planet gears **416**D are each configured to also intermesh with the sun gear **416**A and the ring gear member **416**B.

The planetary gear set **418** includes a sun gear member **418**C, a ring gear member **418**A and a planet gear carrier member **418**B that rotatably supports a set of planet gears **418**D (only one of which is shown). The sun gear member **418**C is connected for common rotation with a stationary member or the transmission housing **436** to prevent the sun gear member **418**C from rotating relative to the transmission housing **436**. The ring gear member **418**A is connected for common rotation with the input member **412**. The planet carrier member **418**B is connected for common rotation with a fifth shaft or interconnecting member **450**. The planet gears **418**D are each configured to intermesh with both the sun gear member **418**C and the ring gear member **418**A.

The input shaft or member **412** is continuously connected to an engine (not shown) or to a turbine of a torque converter (not shown). The output shaft or member **422** is continuously connected with the final drive unit or transfer case (not shown).

The torque-transmitting mechanisms or clutches **426**, **428**, **430** and brakes **432** and **434** allow for selective interconnection of the shafts or interconnecting members, members of the planetary gear sets and the housing. For example, the first clutch **426** is selectively engageable to connect the input member **412** with the third shaft or interconnecting member **446**. The second clutch **428** is selectively engageable to connect the fourth shaft or interconnecting member **448** with the fifth shaft or interconnecting member **450**. The third clutch **430** is selectively engageable to connect the first shaft or interconnecting member **442** with the fifth shaft or interconnecting member **450**. The first brake **432** is selectively engageable to connect the fourth shaft or interconnecting member **448** with the stationary element or the transmission housing **436** in order to restrict the member **448** from rotating relative to the transmission housing **436**. The second brake **434** is selectively engageable to connect the second shaft or interconnecting member **444** with the stationary element or the transmission housing **436** in order to restrict the member **444** from rotating relative to the transmission housing **436**.

Referring now to FIGS. **14** and **15**, the operation of the embodiment of the six speed transmission **400** will be described. It will be appreciated that transmission **400** is capable of transmitting torque from the input shaft or member **412** to the output shaft or member **422** in at least six forward speed or torque ratios and at least one reverse speed or torque ratio. Each forward and reverse speed or torque ratio is attained by engagement of one or more of the torque-transmitting mechanisms (i.e. first clutch **426**, second clutch **428**, third clutch **430**, first brake **432** and second brake **434**), as will be explained below. FIG. **15** is a truth table presenting the various combinations of torque-transmitting mechanisms that are activated or engaged to achieve the various gear states. An "X" in the box means that the particular clutch or brake is engaged to achieve the desired gear state. Actual numerical gear ratios of the various gear states are also presented although it should be appreciated that these numerical values are exemplary only and that they may be adjusted over significant ranges to accommodate various applications and operational criteria of the transmission **400**. An example of the gear ratios that may be obtained using the embodiments of the present invention are also shown in FIG. **15**. Of course, other gear ratios are achievable depending on the gear diameter, gear teeth count and gear configuration selected.

To establish a reverse gear, the second clutch **428** and the second brake **434** are engaged or activated. The second clutch **428** connects the fourth shaft or interconnecting member **448** with the fifth shaft or interconnecting member **450**. The second brake **434** connects the second shaft or interconnecting member **444** with the stationary element or the transmission housing **436** in order to restrict the member **444** from rotating relative to the transmission housing **436**. Likewise, the six forward ratios are achieved through different combinations of clutch and brake engagement, as shown in FIG. **15**.

It will be appreciated that the foregoing explanation of operation and gear states of the six speed transmission **400** assumes, first of all, that all the clutches not specifically referenced in a given gear state are inactive or disengaged and, second of all, that during gear shifts, i.e., changes of gear state, between at least adjacent gear states, a clutch engaged or activated in both gear states will remain engaged or activated.

The description of the invention is merely exemplary in nature and variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.

We claim the following:

1. A transmission comprising:

an input member;

an output member;

first, second and third planetary gear sets each having first, second and third members, wherein the input and output members are each interconnected to at least one of the first, second, and third planetary gear sets, and wherein the third member of the first planetary gear set, the third member of the second planetary gear set and the first member of the third planetary gear set are sun gears, the second member of the first planetary gear set, the second member of the second planetary gear set, and the second member of the third planetary gear set are carrier members and the first member of the first planetary gear set, the first member of the second planetary gear set and the third member of the third planetary gear set are ring gears;

a first interconnecting member continuously interconnecting the third member of the first planetary gear set with a stationary member;

a second interconnecting member continuously interconnecting the second member of the second planetary gear set with the third member of the third planetary gear set;

a third interconnecting member continuously interconnecting the first member of the second planetary gear set with the second member of the third planetary gear set; and

five torque transmitting mechanisms each selectively engageable to interconnect at least one of the first, second and third members of the first, second and third planetary gear sets with at least one other of the first, second, third members and a stationary member, and

wherein the torque transmitting mechanisms are selectively engageable in combinations of at least two to establish at least six forward speed ratios and at least one reverse speed ratio between the input member and the output member.

2. The transmission of claim **1** wherein a first of the five torque transmitting mechanisms is selectively engageable to interconnect the first member of the first planetary gear set with the third member of the second planetary gear set.

3. The transmission of claim **2** wherein a second of the five torque transmitting mechanisms is selectively engageable to interconnect the second member of the first planetary gear set and the input member with the first member of the third planetary gear set.

4. The transmission of claim **3** wherein a third of the five torque transmitting mechanisms is selectively engageable to interconnect the first member of the first planetary gear set with the first member of the third planetary gear set.

5. The transmission of claim **4** wherein a fourth of the five torque transmitting mechanisms is selectively engageable to interconnect the third member of the second planetary gear set with the stationary member.

6. The transmission of claim **5** wherein a fifth of the five torque transmitting mechanisms is selectively engageable to interconnect the second member of the second planetary gear set and the third member of the third planetary gear set with the stationary member.

7. The transmission of claim **1** wherein two of the torque transmitting mechanisms are brakes for connecting a plurality of the first, second, and third members to the stationary member and three of the torque transmitting mechanisms are clutches for connecting at least one of the first, second, and third members of the first, second and third planetary gear sets to at least one other first, second and third members.

8. The transmission of claim **1** wherein the input member is continuously interconnected to the second member of the first planetary gear set.

9. The transmission of claim **1** wherein the output member is continuously interconnected to the second member of the third planetary gear set and to the first member of the second planetary gear set.

10. A transmission comprising:

an input member;

an output member;

first, second and third planetary gear sets each having first, second and third members;

a first interconnecting member continuously interconnecting the third member of the first planetary gear set with a stationary member;

a second interconnecting member continuously interconnecting the second member of the second planetary gear set with the third member of the third planetary gear set;

a third interconnecting member continuously interconnecting the first member of the second planetary gear set with the first member of the third planetary gear set;

a first torque transmitting mechanism selectively engageable to interconnect the second member of the first planetary gear set and the input member with the third member of the second planetary gear set;

a second torque transmitting mechanism selectively engageable to interconnect the second member of the first planetary gear set and the input member with the first member of the second planetary gear set and the first member of the third planetary gear set;

a third torque transmitting mechanism selectively engageable to interconnect the first member of the first planetary gear set with the first member of the second planetary gear set and the first member of the third planetary gear set;

a fourth torque transmitting mechanism selectively engageable to interconnect the third member of the second planetary gear set with the stationary member; and

a fifth torque transmitting mechanism selectively engageable to interconnect the second member of the second planetary gear set and the third member of the third planetary gear set with the stationary member, and

wherein the torque transmitting mechanisms are selectively engageable in combinations of at least two to establish at least six forward speed ratios and at least one reverse speed ratio between the input member and the output member.

11. The transmission of claim **10** wherein the third member of the first planetary gear set, the first member of the second planetary gear set and the first member of the third planetary gear set are sun gears, the second member of the first planetary gear set, the second member of the second planetary gear set, and the second member of the third planetary gear set are carrier members and the first member of the first planetary gear set, the third member of the second planetary gear set and the third member of the third planetary gear set are ring gears.

12. The transmission of claim **10** wherein the input member is continuously interconnected to the second member of the first planetary gear set.

13. The transmission of claim **10** wherein the output member is continuously interconnected to the second member of the third planetary gear set.

14. A transmission comprising:

an input member;

an output member;

first, second and third planetary gear sets each having first, second and third members;

a first interconnecting member continuously interconnecting the first member of the first planetary gear set with a stationary member, wherein the first interconnecting member is not connected to the second or third planetary gear sets;

a second interconnecting member continuously interconnecting the second member of the second planetary gear set with the third member of the third planetary gear set;

a third interconnecting member continuously interconnecting the first member of the second planetary gear set with the second member of the third planetary gear set;

a first torque transmitting mechanism selectively engageable to interconnect the second member of the first planetary gear set with the third member of the second planetary gear set;

a second torque transmitting mechanism selectively engageable to interconnect the third member of the first planetary gear set and the input member with the second member of the second planetary gear set and the third member of the third planetary gear set;

a third torque transmitting mechanism selectively engageable to interconnect the second member of the first planetary gear set with the first member of the third planetary gear set;

a fourth torque transmitting mechanism selectively engageable to interconnect the third member of the second planetary gear set with the stationary member; and

a fifth torque transmitting mechanism selectively engageable to interconnect the second member of the second planetary gear set and the third member of the third planetary gear set with the stationary member, and

wherein the torque transmitting mechanisms are selectively engageable in combinations of at least two to establish at least six forward speed ratios and at least one reverse speed ratio between the input member and the output member.

15. The transmission of claim **14** wherein the first member of the first planetary gear set, the third member of the second planetary gear set and the first member of the third planetary gear set are sun gears, the second member of the first planetary gear set, the first member of the second planetary gear set, and the second member of the third planetary gear set are carrier members and the third member of the first planetary gear set, the second member of the second planetary gear set and the third member of the third planetary gear set are ring gears.

16. The transmission of claim **14** wherein the input member is continuously interconnected to the third member of the first planetary gear set.

17. The transmission of claim **14** wherein the output member is continuously interconnected to the second member of the third planetary gear set and the first member of the second planetary gear set.

18. A transmission comprising:

an input member;

an output member;

first, second and third planetary gear sets each having first, second and third members;

a first interconnecting member continuously interconnecting the third member of the first planetary gear set with a stationary member;

a second interconnecting member continuously interconnecting the second member of the second planetary gear set with the second member of the third planetary gear set;

a third interconnecting member continuously interconnecting the third member of the second planetary gear set with the third member of the third planetary gear set;

a first torque transmitting mechanism selectively engageable to interconnect the second member of the first planetary gear set and the input member with the third member of the second planetary gear set and the third member of the third planetary gear set;

a second torque transmitting mechanism selectively engageable to interconnect the second member of the first planetary gear set and the input member with the first member of the second planetary gear set;

a third torque transmitting mechanism selectively engageable to interconnect the first member of the first planetary gear set with the first member of the second planetary gear set;

a fourth torque transmitting mechanism selectively engageable to interconnect the third member of the second planetary gear set and the third member of the third planetary gear set with the stationary member; and

a fifth torque transmitting mechanism selectively engageable to interconnect the second member of the second planetary gear set and the second member of the third planetary gear set with the stationary member, and

wherein the torque transmitting mechanisms are selectively engageable in combinations of at least two to establish at least six forward speed ratios and at least one reverse speed ratio between the input member and the output member.

19. The transmission of claim **18** wherein the third member of the first planetary gear set, the first member of the second planetary gear set and the third member of the third planetary gear set are sun gears, the second member of the first planetary gear set, the second member of the second planetary gear set, and the second member of the third planetary gear set are carrier members and the first member of the first planetary gear set, the third member of the second planetary gear set and the first member of the third planetary gear set are ring gears.

20. The transmission of claim **18** wherein the input member is continuously interconnected to the second member of the first planetary gear set.

21. The transmission of claim **18** wherein the output member is continuously interconnected to the first member of the third planetary gear set.

22. A transmission comprising:

an input member;

an output member;

first, second and third planetary gear sets each having first, second and third members;

a first interconnecting member continuously interconnecting the third member of the third planetary gear set with a stationary member;

a second interconnecting member continuously interconnecting the second member of the first planetary gear set with the second member of the second planetary gear set;

a third interconnecting member continuously interconnecting the third member of the first planetary gear set with the third member of the second planetary gear set;

a first torque transmitting mechanism selectively engageable to interconnect the first member of the third planetary gear set and the input member with the third member of the second planetary gear set and the third member of the first planetary gear set;

a second torque transmitting mechanism selectively engageable to interconnect the second member of the third planetary gear set with the first member of the second planetary gear set;

a third torque transmitting mechanism selectively engageable to interconnect the second member of the third planetary gear set with the first member of the first planetary gear set;

a fourth torque transmitting mechanism selectively engageable to interconnect the first member of the second planetary gear set with the stationary member; and

a fifth torque transmitting mechanism selectively engageable to interconnect the third member of the second planetary gear set and the third member of the first planetary gear set with the stationary member, and

wherein the torque transmitting mechanisms are selectively engageable in combinations of at least two to establish at least six forward speed ratios and at least one reverse speed ratio between the input member and the output member.

23. The transmission of claim **22** wherein the first member of the first planetary gear set, the first member of the second planetary gear set and the third member of the third planetary gear set are sun gears, the third member of the first planetary gear set, the third member of the second planetary gear set,

and the second member of the third planetary gear set are carrier members and the second member of the first planetary gear set, the second member of the second planetary gear set and the first member of the third planetary gear set are ring gears.

24. The transmission of claim **22** wherein the input member is continuously interconnected to the first member of the third planetary gear set.

25. The transmission of claim **22** wherein the output member is continuously interconnected to the second member of the first planetary gear set and the second member of the second planetary gear set.

26. The transmission of claim **22** wherein the second member of the second planetary gear set and the second member of the first planetary gear set are integrally formed as a single ring gear member.

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